Generating a Long-term Land Data Record from the AVHRR and MODIS instruments

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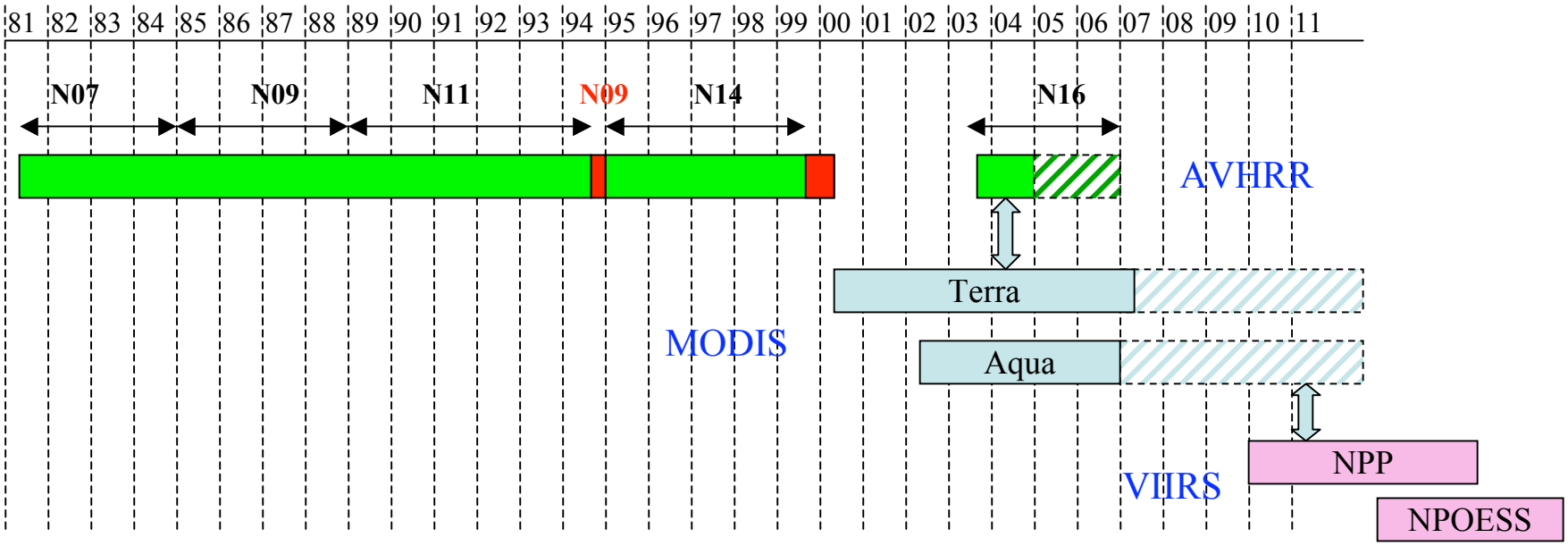
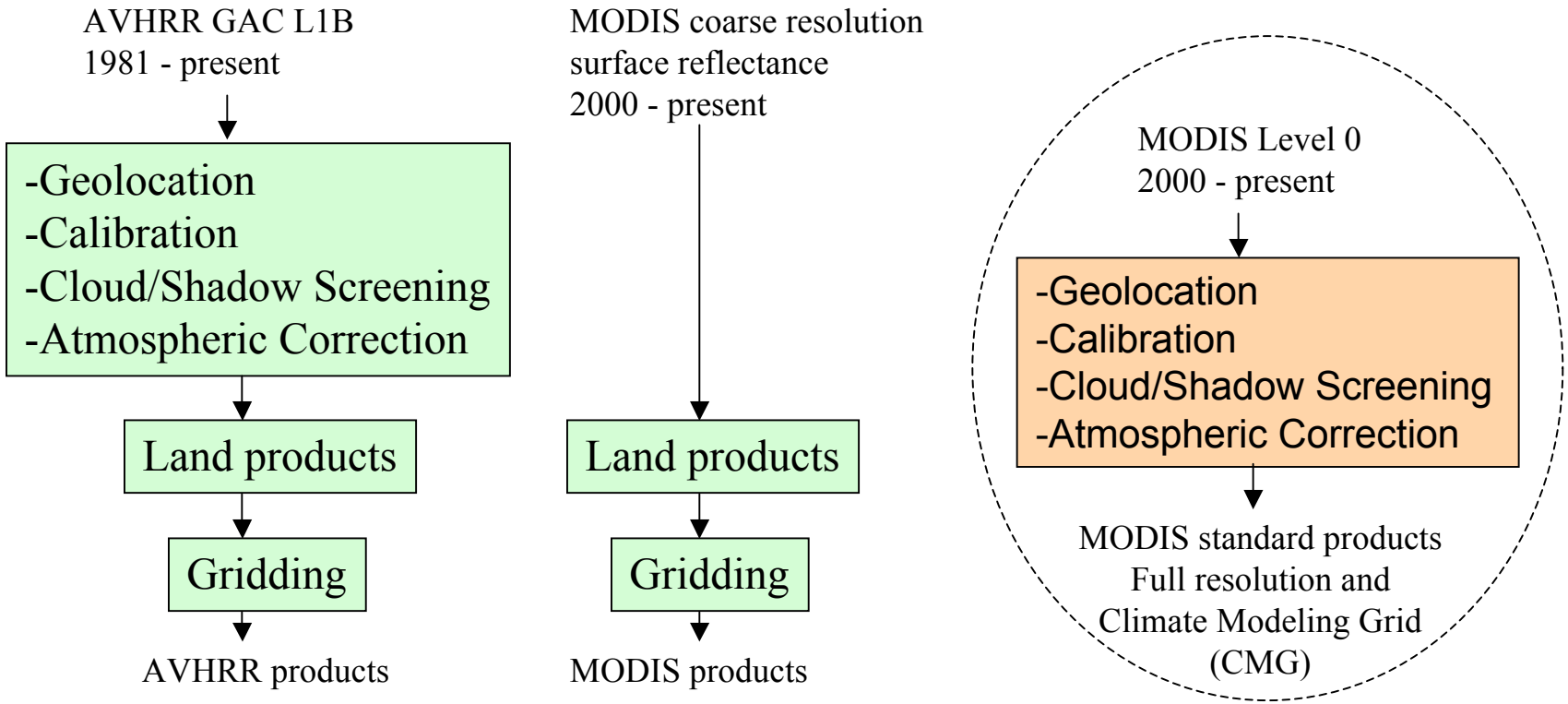
Land Long Term Data Record

- Develop and produce a global long term coarse spatial resolution (0.05°) data record from AVHRR, MODIS (and eventually VIIRS) for use in global change and climate studies.
- Use a MODIS-like operational production approach including an operational QA team.
- Set up an advisory process.
- Make intermediate versions of the data sets available to the community through a web interface and solicit input from users.
- Hold community workshops for outreach and feedback.
- Prototype the development and production of a climate quality data record (CDR).
- Funded by NASA Earth Science Research, Education and Applications Network (REASoN) program.

Data Sources



AVHRR and MODIS Production Systems

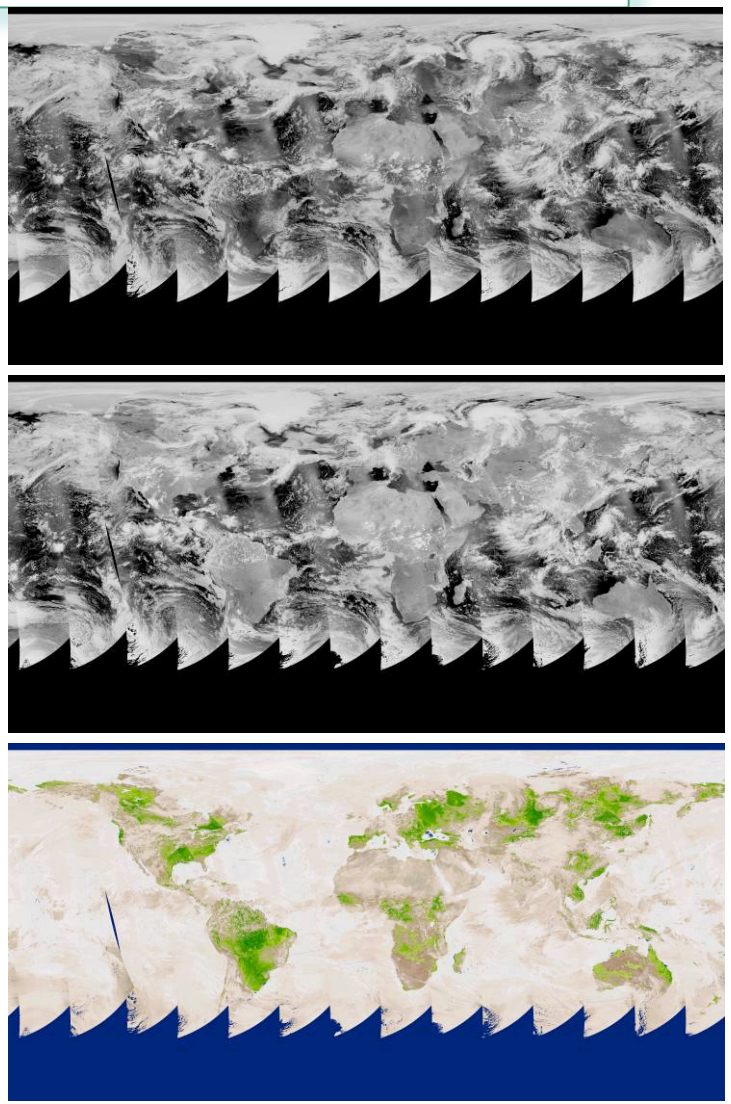


List of potential products:
Surface Reflectance, VI,
Land surface temperature/emissivity,
snow, BRDF/albedo, aerosols,
burned area, LAI/FPAR

Format:
HDF-EOS
Geographic projection 1/20° resolution
Climate Modeling Grid (CMG)
Daily now, multi-day composites later

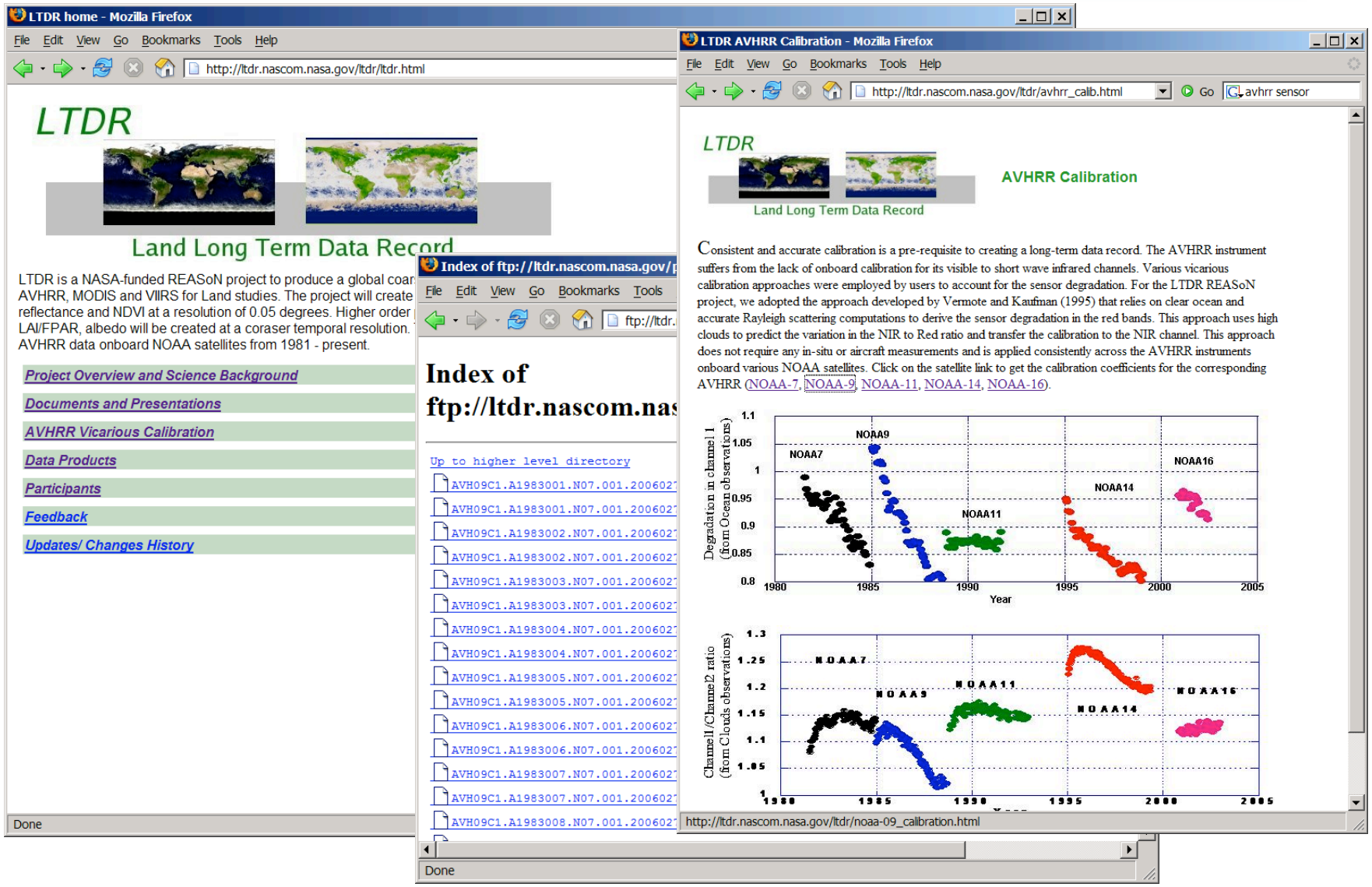
Production of the Beta (Version 1) Data Set Completed Summer 2006

- Algorithms:
  - -Vicarious calibration (Vermote/Kaufman)
  - -Cloud screening: CLAVR-1
  - -Partial Atmospheric Correction:
    - -Rayleigh (NCEP)
    - -Ozone (TOMS)
    - -Water Vapor (NCEP)
- Products:
  - -Daily surface reflectance (AVH09C1)
  - -Daily NDVI (AVH13C1)
- HDF-EOS Format:
  - -Linear Lat/Lon projection
  - -Spatial resolution: 0.05º (Climate Modeling Grid)
- Time Period:
  - -1981 – 2000 completed (Beta = version 1)
- Distribution:
  - -ftp and web
- Evaluation has revealed need for corrections and refinements that will be released in version 2



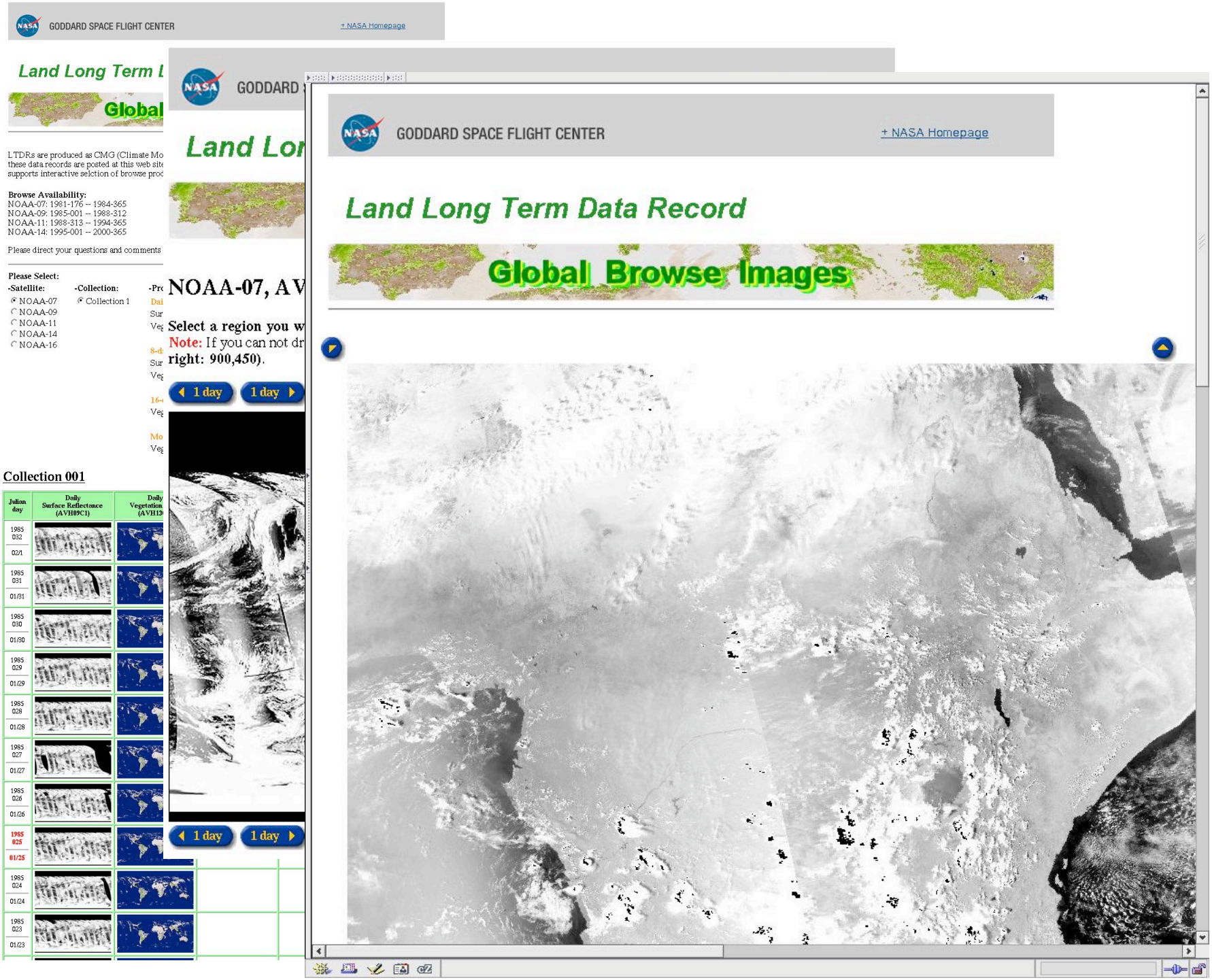
NOAA-11 for 7/11/1992: Ch 1, Ch2 and NDVI

LTDR Web Page



http://ltdr.nascom.nasa.gov/ltdr/ltdr.html

LTDR QA Home Page


GODDARD SPACE FLIGHT CENTER
+ NASA Homepage
Land Long Term Data Record
Global Browse Images
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LTDRs are produced as CMG (Climate Mo
these data records are posted at this web site
supports interactive selction of browse prod
Browse Availability:
NOAA-07: 1981-176 -- 1984-365
NOAA-09: 1985-001 -- 1988-312
NOAA-11: 1988-313 -- 1994-365
NOAA-14: 1995-001 -- 2000-365
Please direct your questions and comments
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-Satellite:
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Collection 1
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1 day
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Daily Surface Reflectance (AVH09C1)
1985 032 02/1
1985 031 01/31
1985 030 01/30
1985 029 01/29
1985 028 01/28
1985 027 01/27
1985 026 01/26
1985 025 01/25
1985 024 01/24
1985 023 01/23

Data Set Evaluation

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Land Long Term Data Re

Time

A time series of summary statistics derived from all the L
locations is maintained and monitored by the LTDR QA pe
internet. Time series statistics are extracted at all aeronet s
series are important because they capture algorithm sensiti
aerosol loading) and remote sensing (e.g. sun-surface-senso
they allow changes in the instrument characteristics and ca
site (listed in aphabetical order) or tile and biome combina

First: Second: Aeronet Golden Tile

Year: 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990

Aeronet area: (Search areas beginning with the selected letter) A B C D E F G H I J

Tiles: h09v05 (Sou h11v03 (Nort h11v08 (Nort h11v11 (Nort h17v07 (Sah h20v11 (Sou h24v04 (Nort h26v04 (Nort h30v11 (Cen

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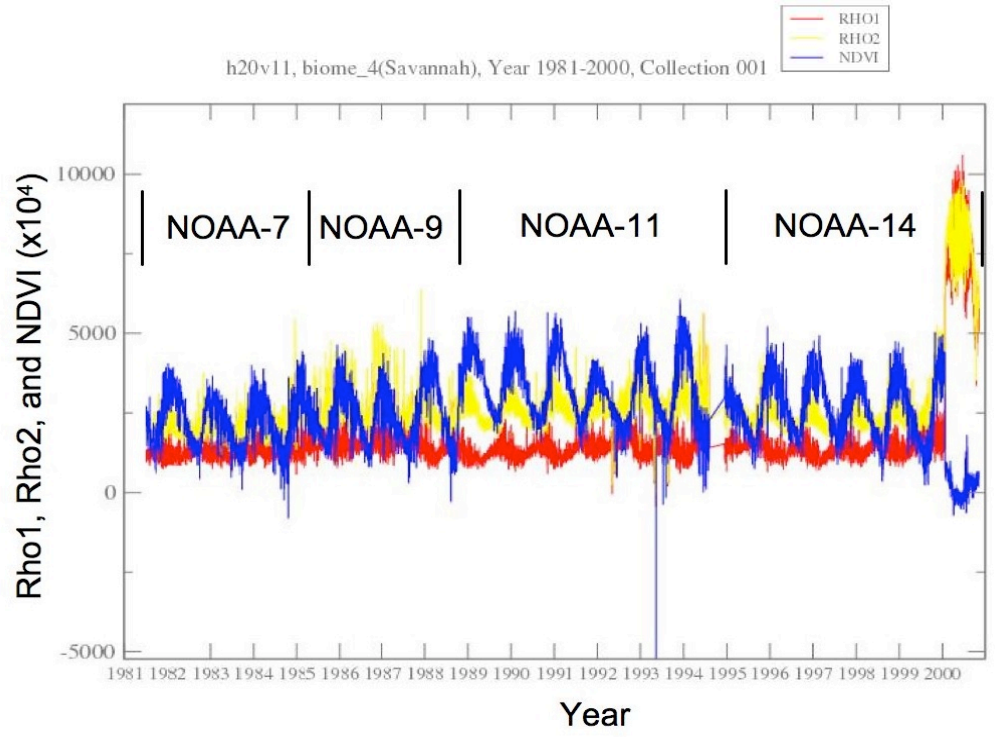
Land Long Term Data Record

Time Series



Fri May 5 11:27:00 2006

The calibration of the AVHRR has been thoroughly evaluated

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Calibration of NOAA16 AVHRR over a desert site using MODIS data

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Abstract

This paper presents a new approach to AVHRR-sensors cross-calibration in the visible to shortwave-infrared spectral domain using an a-priori, well calibrated sensor (MODIS). The approach has been tested over a stable Sahara desert site and was initially applied to compare the absolute calibration coefficients of three different bands of the Terra and Aqua MODIS instruments. The observed agreement was better than 1% for bands 1 (0.67 μm), 2 (0.87 μm) and 7 (2.13 μm). The approach was then applied to cross-calibrate the AVHRR sensor onboard NOAA16. The absolute calibration coefficients derived for bands 1 and 2, using the Terra MODIS as a reference, were compared to the vicarious coefficients derived using the ocean and clouds method [Vermote E.F. and Kaufman Y.J. (1995). Absolute calibration of AVHRR visible and near-infrared channels using ocean and cloud views, International Journal of Remote Sensing, 16, 13, 2317–2340.]. The coefficients were consistent within less than 1%.

Keywords: Calibration; AVHRR; MODIS

Fig 2. Location of the 20 km by 20 km calibration site (centered on the red square) The image represents an area of 1000 km by 1000 km

The coefficients were consistent within less than 1%

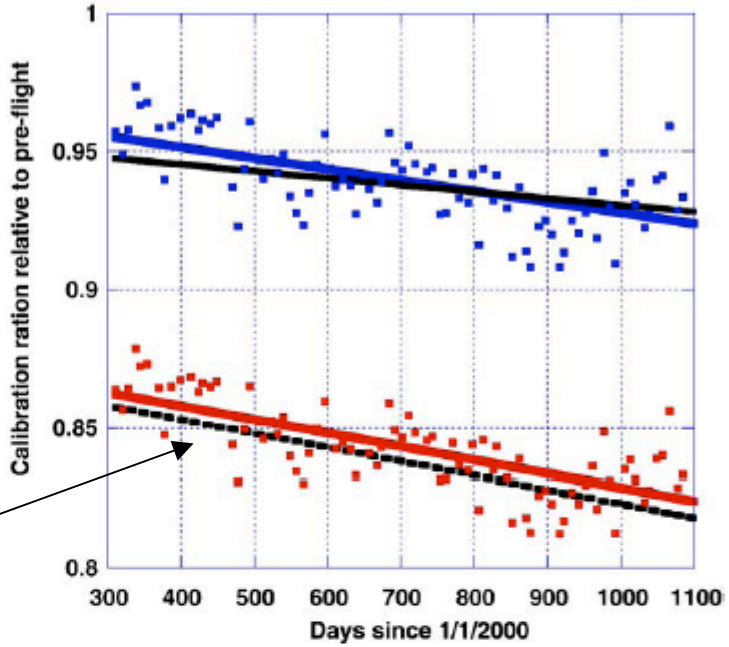
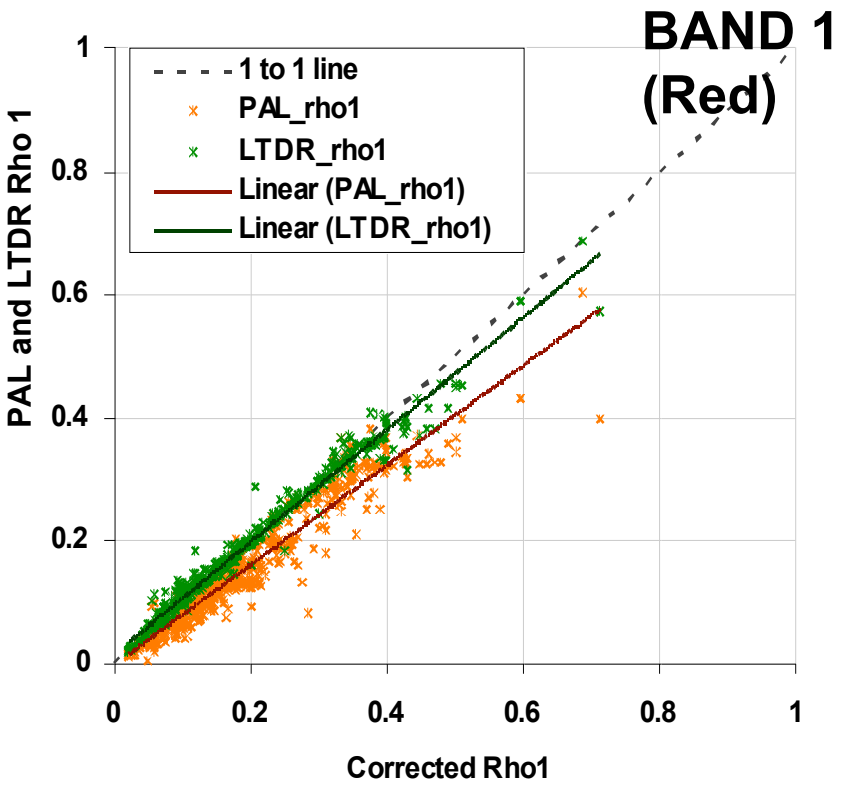
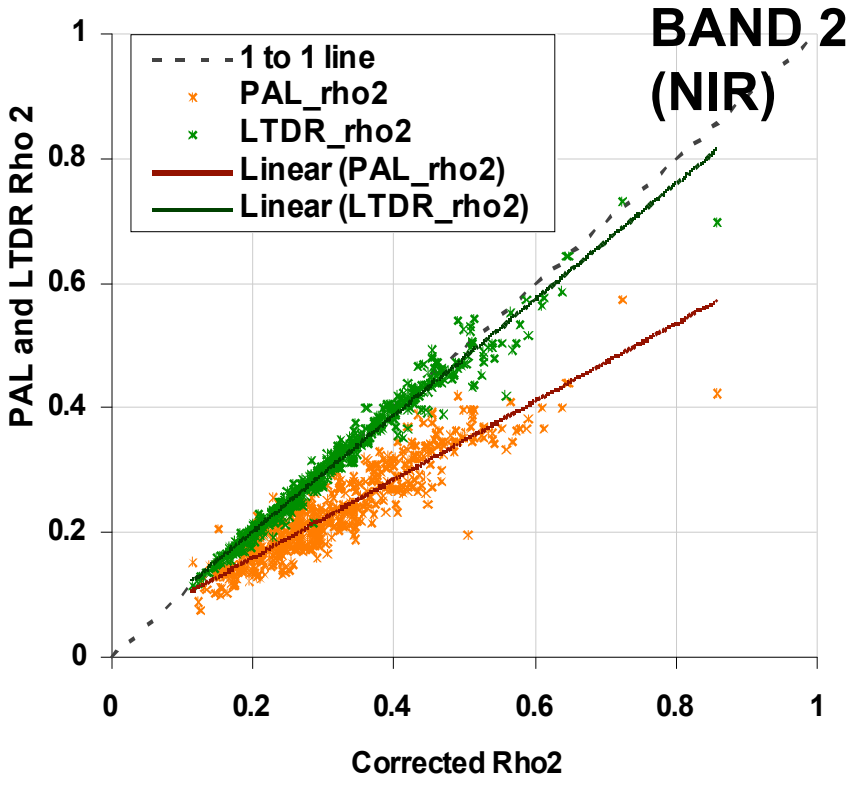


Fig. 11. Comparison of the desert calibration trends for band 1 (black solid line) and band 2 (black interrupted line), with the trends obtained using the Ocean and Clouds method (Vermote and Kaufman, 1995) for band 1 (blue line and square) and band 2 (red line and square).

Comparison of PAL with LTDR at AERONET sites



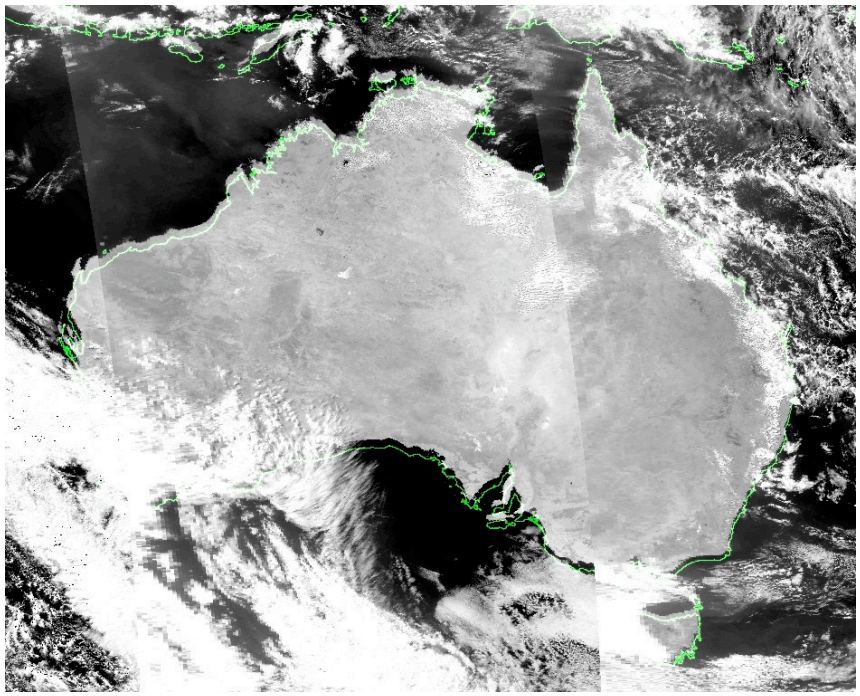


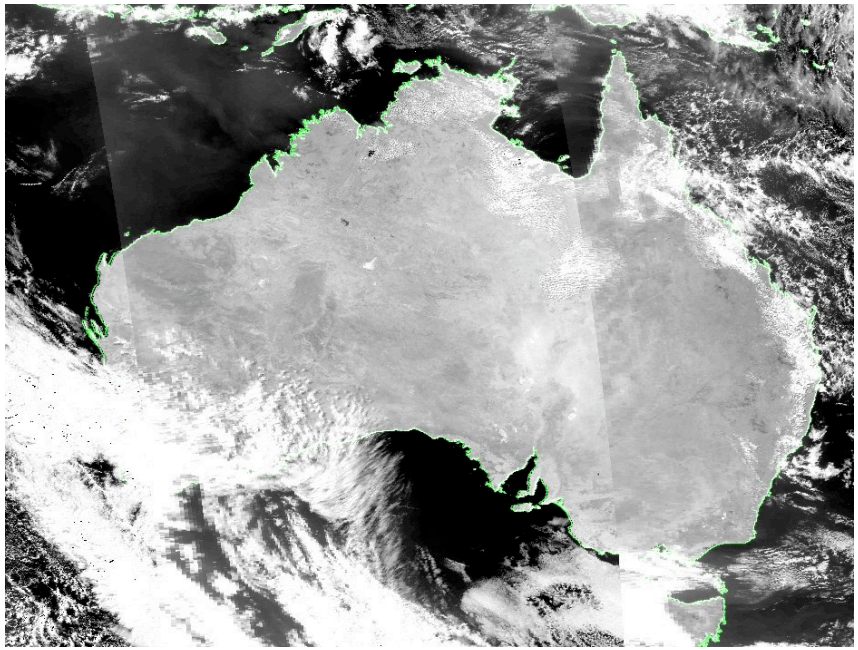
PAL is not corrected for water vapor absorption

Different Calibration:

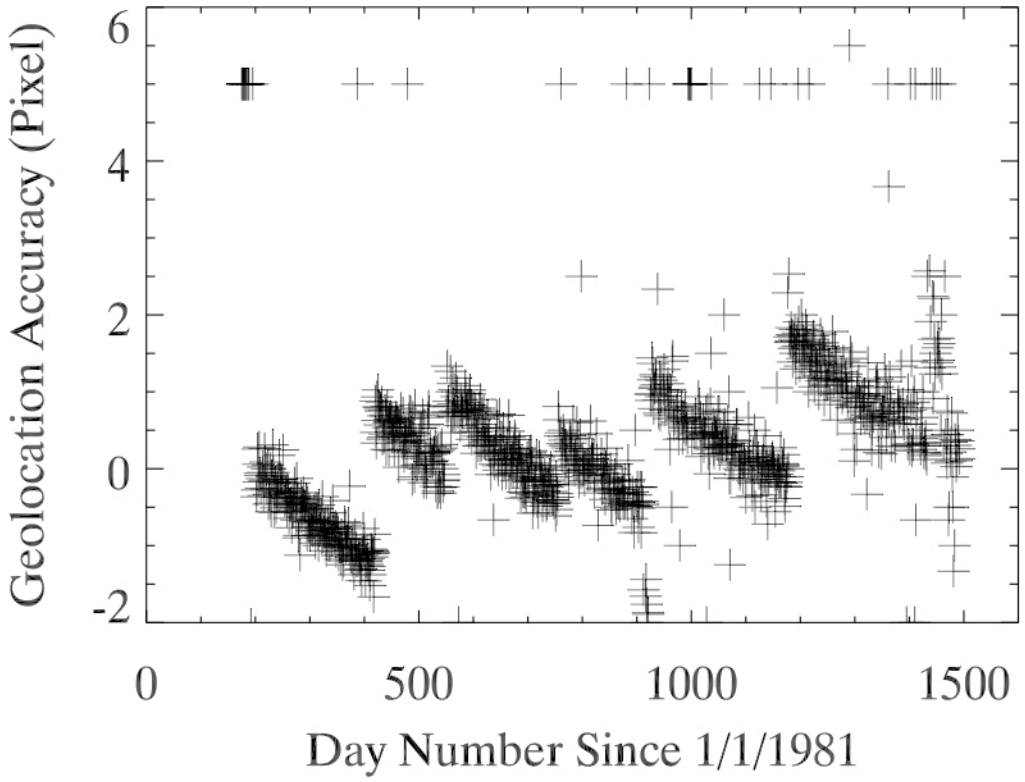
- **PAL**: Stable desert target vicarious calibration (Rao and Chen, 1996)
- **LTDR**: ocean-cloud vicarious calibration (Vermote and Kaufman, 1995)

Geolocations issues/bad ephemeris data

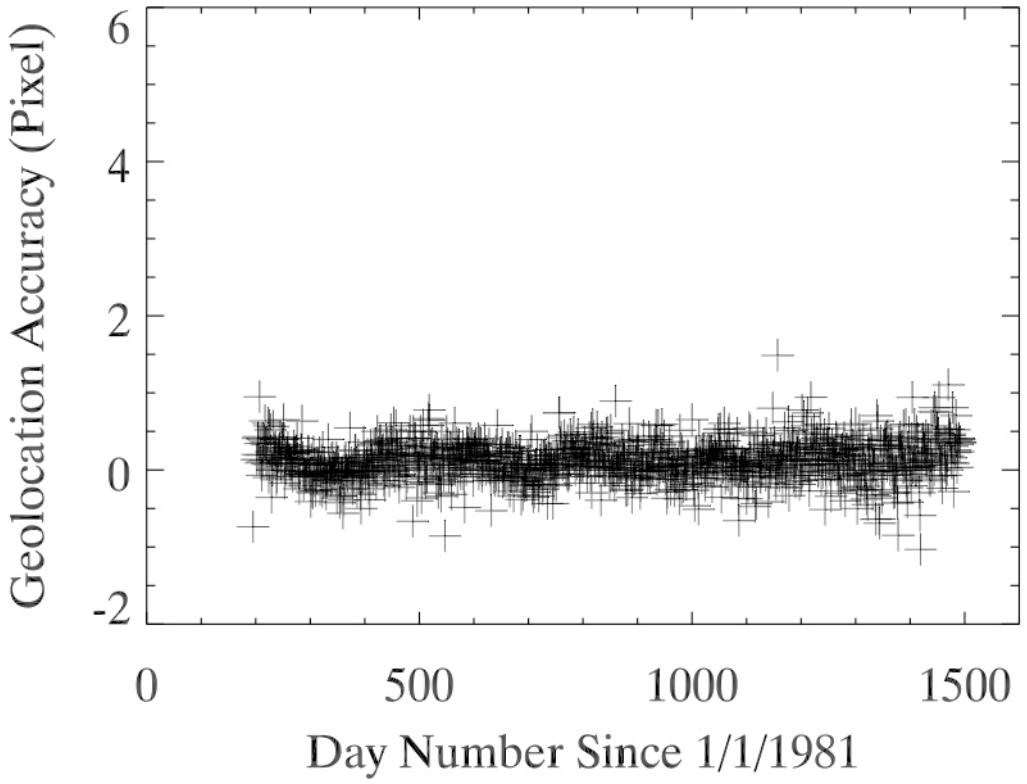




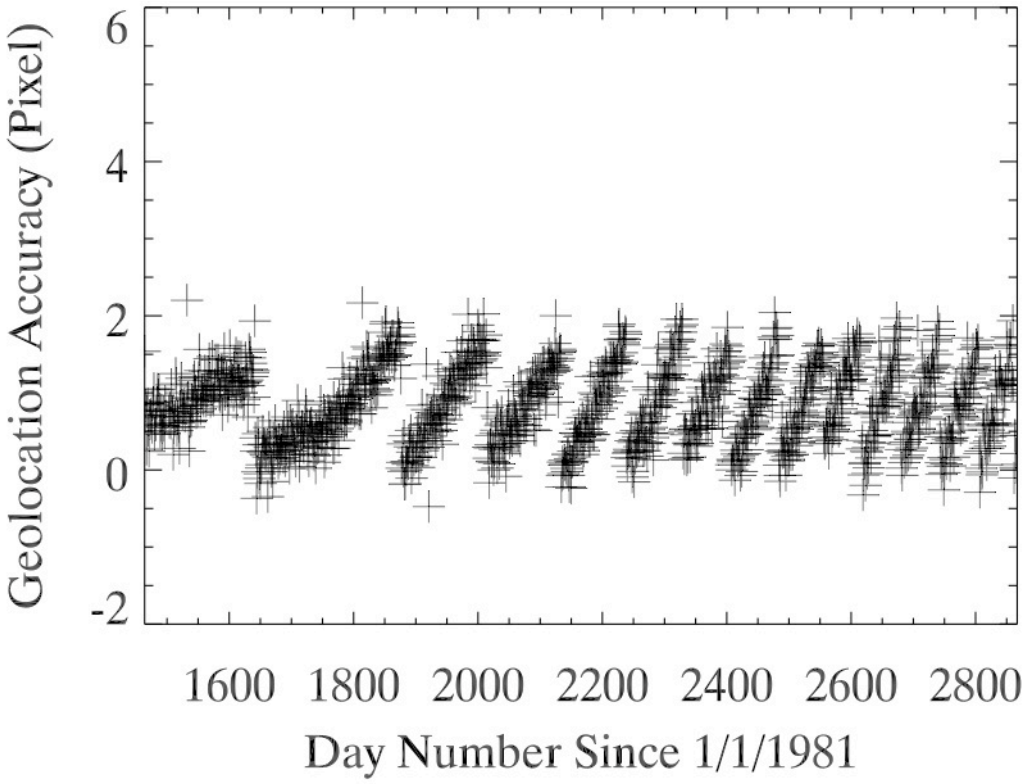
NOAA-7: Geolocation Accuracies (Original)



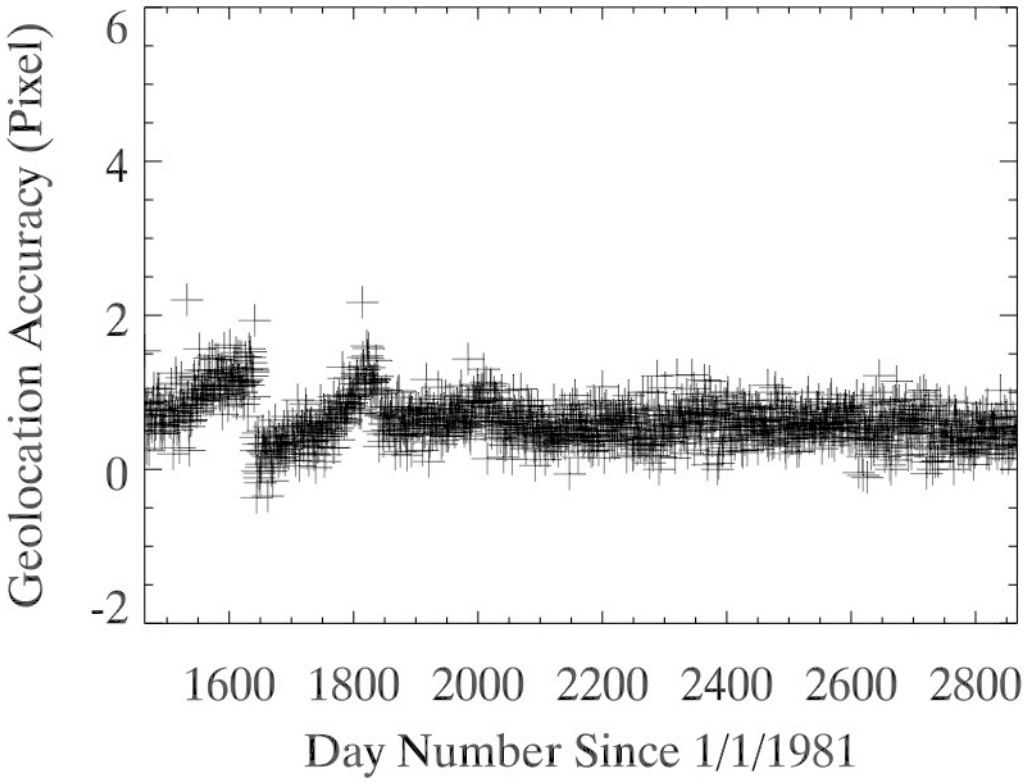
NOAA-7: Geolocation Accuracies (After processing)



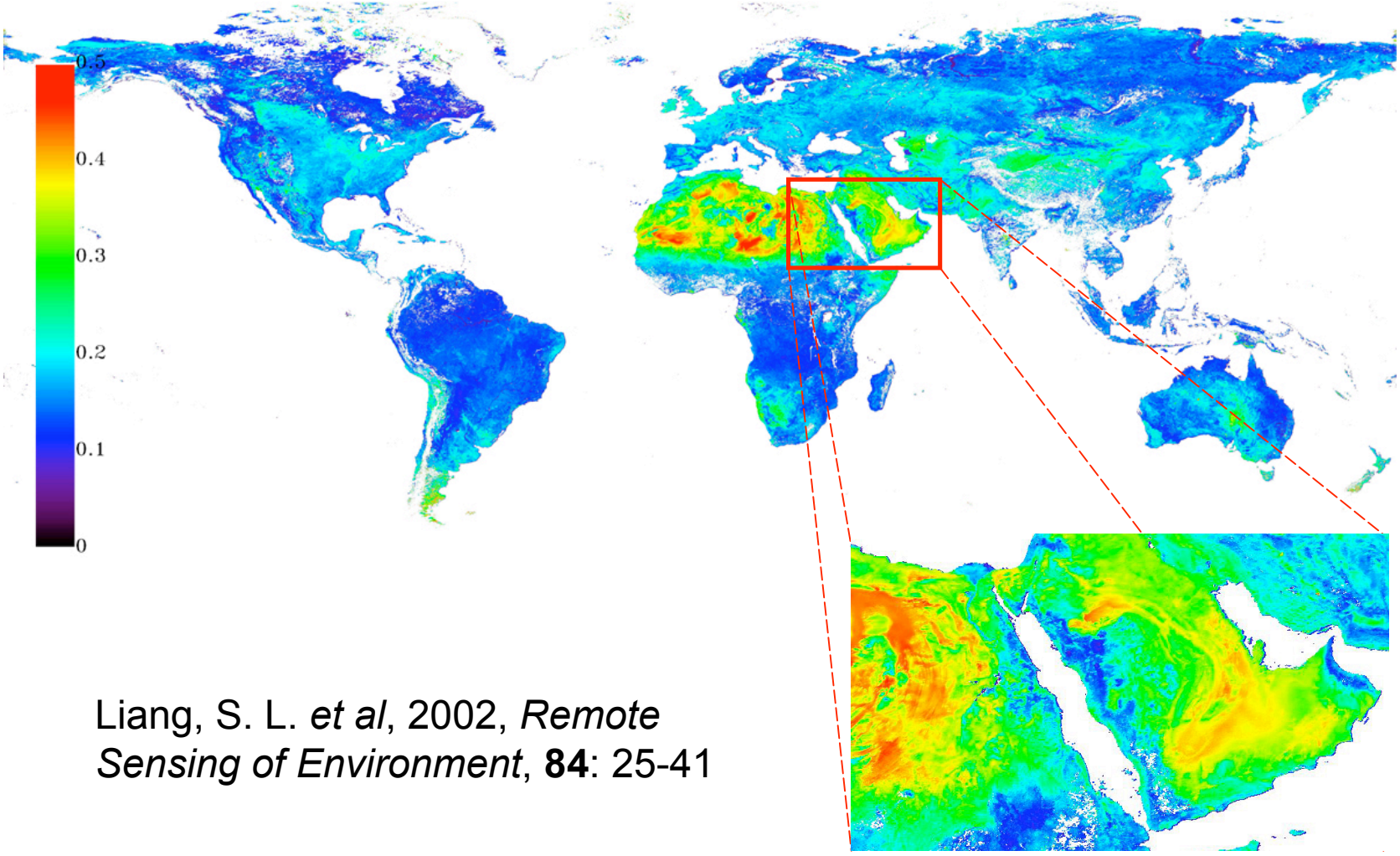
NOAA-9: Geolocation Accuracies (Original)



NOAA-9: Geolocation Accuracies (After processing)

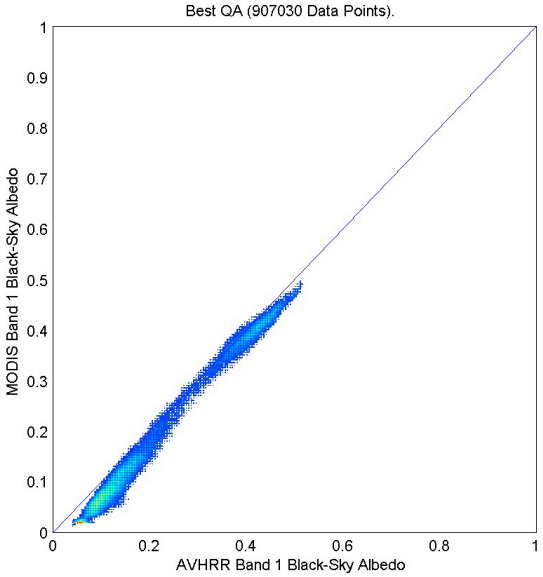


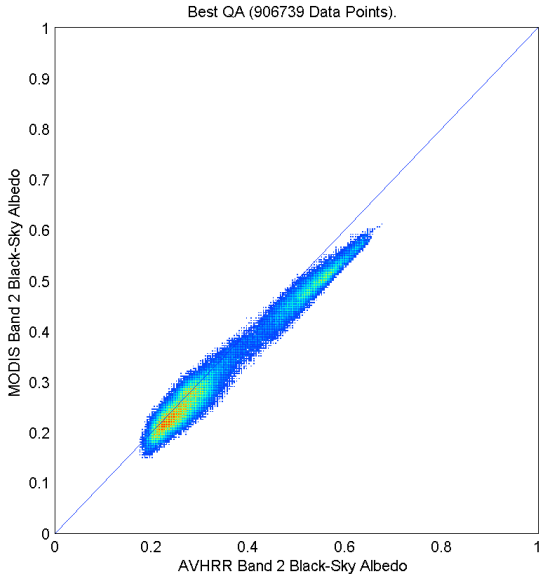
AVHRR BRDF/Albedo Product: Broadband Black-Sky Albedo (July 1999)

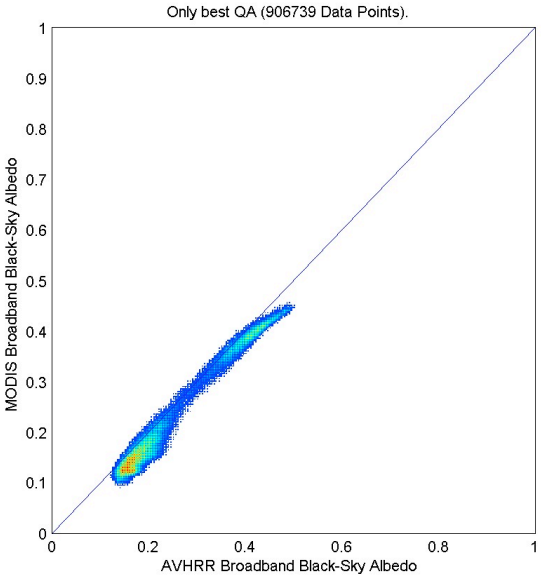


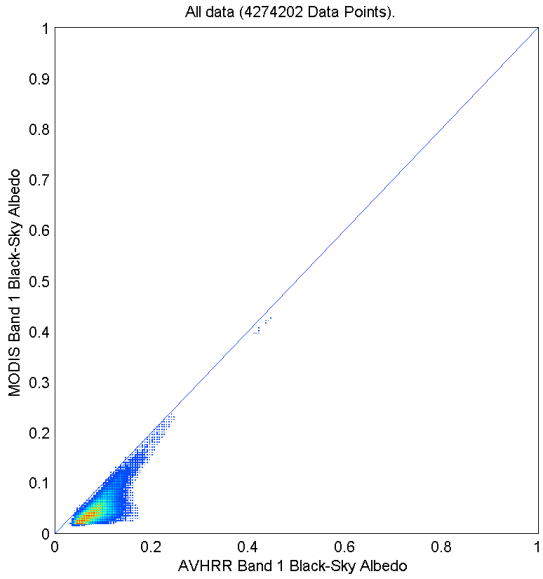
Liang, S. L. *et al*, 2002, *Remote Sensing of Environment*, **84**: 25-41

Albedo evaluation









Outreach workshop

- LTDR workshop held January 18, 2007 at the UMUC Conference Center
    - Held in conjunction with MODIS Collection 5 workshop
    - Most in C5 workshop stayed for LTDR Outreach Workshop
    - Goal was to present project status, receive feedback on products/schedule
- Approximately 140 attendees, including MODIS/AVHRR project personnel.
- Presentations from LTDR folks (algorithms, science, QA, data formats, evaluation, intercomparisons with existing AVHRR products)
- Also presentations from international AVHRR experts
    - A. Trischenko (CCRS) “Developing the AVHRR and MODIS Long Term Data Records at the CCRS”
    - P. Frost (CSIRO) “Integration of Sensors Applied on South African Ecosystems (ISAFE)”
    - M. Leroy (CESBIO) “African Monsoon Multidisciplinary Analysis (AMMA)”
- Good interaction and feedback.

Future activities

- Produce much improved (version 2) surface reflectance and NDVI data set for 1981-1999 and 2003 [September]
- Produce preliminary aerosol-corrected data set for 1999 and 2003 [Oct-Nov]
  - *Use coincident MODIS and AVHRR data to improve aerosol retrieval and correction in AVHRR*
- Release aerosol-corrected surface reflectance and NDVI data set (version 3) [December]
- Produce BRDF/Albedo
- Produce/Release Land Surface Temperature
- Produce Burned Area
- Release version 4 surface reflectance/NDVI data set incorporating fixes identified since version 3 release [2008]
  - Workshop will be held in conjunction with version 4 release.